Root Exudate Profiling in Sorghum

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Root exudation refers to the processes by which plants release compounds called root exudates into the soil. These exudates are primarily carbon-containing compounds that interact with microbial communities in the rhizosphere. Microbial consumption of exudates reduces the concentration of the exudated compounds in the soil, causing the plant to exude more of those compounds. Currently, there is limited understanding of the interaction between plant-root exudation mechanisms and the surrounding microbial communities.

Among the Sorghum Association Panel (SAP), an established and genetically characterized sorghum diversity panel, we observed a spectrum of root colors (tan, yellow, red, purple-brown, black) identical to the range of observed sorghum seed colors. Previous studies examining differentially expressed metabolites between colorful seeds showed that flavonoids and anthocyanins were higher in dark seeds than white seeds. Root color is genotype-dependent and consistent over time. We hypothesized that the observed color diversity of sorghum roots was due to differential metabolite profiles in the root exudates across genotypes.

We designed an experiment to collect exudates from 15 genotypes (n=60). After three weeks of growth, sorghum roots were washed and submerged in ultrapure water for 24 hours. The hydroponic solution was filtered and incubated with methanol. The whole root system was also ground after exudation. The root exudate solutions and the ground-up roots underwent either HILIC and RPLC analysis to separate and detect polar and hydrophobic metabolites.

Through metabolite profiling of root exudates, we aim to identify sorghum genotypes that more efficiently allocate carbon below ground via their root systems.